

What is claimed is:

1. A catheter system for delivering a fluid to heart tissue, comprising:

a pressurized fluid source containing a fluid therein, the pressurized fluid source generating a high transient pressure sufficient to pierce bodily tissue; and

an injection catheter including an elongate shaft having a proximal end, a distal end and an infusion lumen extending therein, the proximal end of the shaft connected to the pressurized fluid source, the infusion lumen in fluid communication with the fluid contained in the pressurized fluid source, the distal end of the shaft including a nozzle having an injection port in fluid communication with the infusion lumen such that fluid from the pressurized fluid source may be delivered to the heart tissue via the infusion lumen of the shaft and the injection port at a sufficient exit velocity to partially penetrate the heart tissue.

2. A catheter system as in claim 1, wherein the shaft of the injection catheter is formed of a metal to withstand the high transient pressure.

3. A catheter system as in claim 2, wherein the shaft of the injection catheter is formed of stainless steel along a substantial length thereof.

4. A catheter system as in claim 2, wherein the shaft of the injection catheter is formed of a super elastic alloy along a substantial length thereof.

5. A catheter system as in claim 1, wherein the shaft of the injection catheter

is formed of a metal reinforced polymer composite to withstand the high transient pressure.

6. A catheter system as in claim 5, wherein the shaft of the injection catheter is formed of a stainless steel reinforced polymer along a substantial length thereof.

7. A catheter system as in claim 5, wherein the shaft of the injection catheter is formed of a super elastic alloy reinforced polymer along a substantial length thereof.

8. A catheter system as in claim 1, wherein the injection port has a diameter of 0.05 inches or less.

9. A catheter system as in claim 1, wherein the injection port has a diameter of 0.010 inches or less.

10. A catheter system as in claim 1, wherein the injection port has a diameter of 0.005 inches or less.

11. A catheter system as in claim 1, wherein the nozzle defines a nozzle lumen having a diameter, and wherein the injection port has a diameter substantially the same as the diameter of the nozzle lumen.

12. A catheter system as in claim 1, wherein the nozzle defines a nozzle lumen

having a diameter, and wherein the injection port has a diameter smaller than the diameter of the nozzle lumen to increase the exit velocity of the fluid.

13. A catheter system as in claim 1, wherein the nozzle defines a nozzle lumen having a diameter, and wherein the injection port has a diameter larger than the diameter of the nozzle lumen to decrease the exit velocity of the fluid.

14. A catheter system as in claim 1, wherein the nozzle includes a sharpened distal end to partially penetrate the heart tissue.

15. A catheter system as in claim 1, wherein the the injection port is directed distally.

16. A catheter system as in claim 1, wherein the the injection port is directed laterally. 7

17. A catheter system as in claim 1, further comprising:  
a vacuum source; and  
a sheath disposed about the injection catheter, the sheath having a proximal end, a distal end and a suction lumen disposed therein, the proximal end of the sheath connected to the vacuum source with the suction lumen of the sheath in fluid communication with the vacuum source, wherein the distal end of the sheath is disposed adjacent the heart tissue such that the distal end of the sheath is stabilized against the heart tissue when a

vacuum is applied to the suction lumen using the vacuum source.

18. A method of delivering a fluid to an injection site in heart tissue of a patient, comprising the steps of:

providing a pressurized fluid source containing a fluid therein, the pressurized fluid source generating a high transient pressure sufficient to pierce bodily tissue;

providing an injection catheter comprising a shaft having a proximal end, a distal end and an infusion lumen extending therein, the distal end of the catheter including a nozzle and an injection port;

inserting the injection catheter into the patient;

navigating the catheter until the distal end of the catheter is positioned adjacent the injection site; and

actuating the fluid source to inject fluid into the heart tissue via the infusion lumen of the shaft and the injection port at a sufficient exit velocity to partially penetrate the heart tissue.